

Appl. No. : 09/674,415
Filed : April 30, 1999

REMARKS

In response to the Office Action mailed October 1, 2002, Applicant respectfully requests the Examiner to reconsider the above-captioned application in view of the above amendments and the following comments.

The specification has been amended to provide better readability. Claims 51, 54, 57, 61, 66-69, 78, 81-82 and 86-88 have been amended. The amendments to the claims are made merely for clarification, thus no new matter has been introduced. In addition, the amendments to the claims do not narrow the scope of the protection.

The specific changes to the amended claims are shown on the previous pages on separate sheets entitled **AMENDMENTS TO THE CLAIMS**, respectively. On this set of pages, the insertions are underlined while the ~~deletions are struck through~~.

Discussion of Substitute Specification

Applicant has amended the specification to be written in full, clear, and exact terms to meet the requirement of 35 U.S.C. § 112, first paragraph. The title of the invention has been amended to "Electrons Sources with Whisker Field Emitters, and Method of Manufacturing" as suggested by the Examiner. Also, an abstract has been submitted on a separate sheet.

According to 37 C.F.R. § 1.125, Applicant hereby submits a substitute specification. All the changes (including the matter being added to and the matter being deleted from) made in the substitute specification are supported by the original specification and drawings. Thus, the substitute specification includes no new matter. A marked up version of the substitute specification showing all the changes to the specification, and a version of the substitute specification without markings as to amended material are submitted with this paper. On the marked up version, the additions are underlined while the ~~deletions are struck through~~.

Discussion of the Drawings Amendments

Figures 1-3 have been amended to designate the drawings as "Prior Art." Figures 2a and 2b have been amended to remove reference numerals that were not mentioned in the specification.

Figure 4d has been amended to change the reference numeral from "00" to "06 ." Figure 6a has been amended to change the reference numeral from "09" to "09 ." Accordingly, the

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reference numeral for "conducting substrate" in the specification at page 8, line 9, has been changed from "09" to "09'."

Thus, the drawing changes do not introduce any new matter to the subject matter. With the Examiner's approval, the changes will be incorporated in the formal drawings upon indication of allowance.

Discussion of Objections of the Drawing

The Examiner states that Figures 1-3 should be designated by a legend such as – Prior Art – because only that which is old is illustrated. In response, Applicant has designated the drawings as "Prior Art" as discussed above.

Discussion of the Drawing Objections Under 37 CFR 1.84(p)(4)

The Examiner asserts that reference character "04" has been used to designate both "first p-n junction" (page 2, line 40) and "barrier" (page 7, line 1). Applicant respectfully submits that it is clear to a person having ordinary skill in the art that the term "barrier (junction)" at page 7, line 1 represents the p-n junction. However, to provide better readability, Applicant has amended the specification to change the term from "barrier (junction)" to "barrier (p-n junction)."

The Examiner notes that reference character "01" has been used to designate both "top of field emitter" (page 7, line 1) and "whisker-grown field emitter" (page 8, line 9). Applicant respectfully submits that both of the terms represent the same element. However, to provide better readability, Applicant has amended the specification at page 7, line 1 to change the term from "top of field emitter" to "top of whisker-grown field emitter."

The Examiner states that reference character "09" has been used to designate "control electrode" (page 7, line 2). However, Applicant respectfully submits that reference character "08" instead of "09" has been used to designate "control electrode" as discussed in the specification at page 7, line 1.

The Examiner also states that reference character "09" has been used to designate "conductive strips" (page 7, line 25), and "conducting substrate" (page 8, line 9). In reply, as discussed above, Figure 6a has been amended to change the reference numeral from "09" to "09'" and the specification at page 8, line 9 has been amended accordingly.

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The Examiner asserts that reference character "01" has been used to designate different parts in different embodiments in Figures 3a and 4a-4e. However, Applicant respectfully submits that reference character "01" has been used to designate the same element, which is "top of field emitter" in Figures 3-6.

Also, reference character "02" in Figures 3a, 6a and 6b has been used to designate the same element, which is "control electrode or a set of parallel (control electrode) strips." For clarity, Applicant has amended the specification at page 8, line 13 to change the term from "a set of parallel strips" to "a set of parallel (control electrode) strips."

In addition, reference character "03" in Figures 3a, 6a and 6b has been used to designate the same element, which is "insulator." Furthermore, reference characters "04" and "06" in Figures 3-7 have been used to designate the same element, which is "barrier or p-n junction."

Discussion of the Drawing Objections Under 37 CFR 1.84(p)(5)

The Examiner asserts that reference characters 110-180 in Figure 2a and 210-280 in Figure 2b were not mentioned in the specification. In reply, Figures 2a and 2b have been amended to remove the reference numerals from the drawings.

Discussion of the Drawing Objections Under 37 CFR 1.84(a)

The Examiner asserts that the element "ballast resistor" recited in Claims 51, 67 and 69 must be shown on the drawings. The specification at page 7, lines 33-34 discloses that the junction (p-n junction) between the p-type of silicon and the n-type silicon coating acts as a ballast resistor. That is, the term "ballast resistor" represents the p-n junction. The p-n junction is illustrated as reference numerals "04" or "06" on Figures 4-7. In view of the above, Applicant respectfully submits that the element "ballast resistor" is shown on the drawings.

The Examiner also asserts that the element "barrier" recited in Claim 53 must be shown on the drawings. As discussed above and disclosed in the specification at page 7, line 1, the term "barrier" also represents the p-n junction. Since, the p-n junction is illustrated as reference numeral "04" or "06" on Figures 4-7, Applicant respectfully submits that the element "barrier" is shown on the drawings.

The Examiner notes that the feature "the body of the field emitter being a whisker epitaxial to the substrate" recited in Claims 51 and 82 must be shown on the drawings. Please

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note that the language "a whisker epitaxial to the substrate" in Claims 51 and 82 has been amended to "a whisker epitaxially grown on the substrate." Applicant respectfully submits that epitaxial nature of the whisker cannot be shown on the drawing. Furthermore, Applicant respectfully submits that the concept of the epitaxial growth is well known and immediately recognizable to one skilled in the technology of the present invention.

The Examiner notes that the feature "the body of the field emitter being configured as a blade" recited in Claim 67 must be shown on the drawings. Applicant respectfully requests that the Examiner take note that the language "blade" has been amended to "whisker." The feature "the body of the field emitter being configured as a whisker" is shown, for example, in Figures 4-6 in connection with reference numeral "01."

Summary

As discussed above, the drawings of this application meet the requirements pointed out by the Examiner. In view of the above, withdrawal of the drawing objections is respectfully requested.

Discussion of Claim Rejections Under 35 U.S.C. 112, ¶ 1

The Examiner has rejected Claims 51-88 under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification. The Examiner asserts that the specification or drawings fail to disclose how the different parts of the invention are related to one another or how they interact together. The Examiner also asserts that the method claims merely state forming the necessary parts of the claimed invention without first disclosing them in the specification and drawings.

Applicant respectfully submits that all of the claims are supported by either the original claims or the drawings as discussed below. For example, Figure 5a or 5b shows all of the elements recited in independent Claims 51, 67 and 69. Also, independent Claim 72 is supported by Figures 6 and 6b. The remaining claims are supported by either the original claims as amended, the summary of the invention section, or the drawings.

Discussion of Claim Rejections Under 35 U.S.C. 112, ¶ 2

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The Examiner has rejected Claims 51-88 under 35 U.S.C. 112, second paragraph as being indefinite. However, all of the pending claims meet the 35 U.S.C. 112, second paragraph requirement as discussed below.

Discussion of Claim 51

The Examiner asserts that Claim 51 is indefinite as it is not clear how the different elements of the claimed invention are related to one another. However, Applicant respectfully submits that all of the elements "substrate," "field emitter," "source" and "ballast resistor" of Claim 51 are interconnected to one another as clearly recited in the claim.

The Examiner asserts that Claim 51 is indefinite if the claimed invention includes different materials in the field emitter (or proximate to it) or not. However, Applicant respectfully disagrees with the Examiner as discussed below.

The language "different materials located in or proximate to the field emitter" may be restated as "different materials located in the field emitter or located proximate to the field emitter." First of all, an alternative expression using "or" between "located in" and "located proximate to" is acceptable. MPEP 2173.05(h) II. "OR" TERMINOLOGY.

Also, regarding the term "located proximate to," the fact that claim language, including terms of degree, may not be precise, does not automatically render the claim indefinite under 35 U.S.C. §112, second paragraph. Acceptability of the claim language depends on whether one of ordinary skill in the art would understand what is claimed in light of the specification. Even if the specification does not provide for some standard for the language, a determination is made as to whether one of ordinary skill in the art, in view of the prior art and the status of the art, would be nevertheless reasonably apprised of the scope of the invention. MPEP 2173.05(b).

Also, Applicant respectfully submits that the meaning of the term "proximate to" includes "near." This is clear because the term "a barrier between different materials located in the field emitter or located proximate to the field emitter" refers to the "p-n junction" as shown in Figures 4-6 ("04" or "06"). Thus, Applicant believes that the language "located in or proximate to the field emitter" is clear and definite. In view of the above, Applicant respectfully submits that Claim 51 is clear and definite.

Discussion of Claim 57

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The Examiner asserts that Claim 57 is indefinite as it is not clear what the applicant intended to claim with the limitation semiconductor materials with opposite conductivity types. In reply, Applicant has amended the term from "opposite conductivity types " to "opposite conductivities." Applicant believes that Claim 57 as amended is clear and definite.

Discussion of Claims 59 and 60

The Examiner asserts that Claims 59 and 60 are indefinite as it is not clear what the applicant intended to cover with the use of the phrase "diamond-like material." Applicant respectfully disagrees with the Examiner because the term "diamond-like material" is definable and widely used. A diamond-like material has properties that are similar to diamond. As an example, an international symposium named "Diamond-like semiconductors" was held on November 22 through 23, 2002. A copy showing the title of the symposium is enclosed herewith.

Discussion of Claim 61

The Examiner asserts that Claim 61 is indefinite as it is not clear with respect to what frame of reference the inner part and outer part are defined. In reply, Applicant has amended the term from "a broad inner part and a more narrow outer part" to "a broad lower part and a narrower upper part." In one embodiment of the invention, the language "a broad lower part and a narrower upper part" refers to the field emitter (01: a top of the field emitter) as shown in Figures 4-6. Thus, amended Claim 61 is clear and definite.

Discussion of Claim 67

The Examiner asserts that Claim 67 is indefinite as it is not clear how the different elements of the claimed invention are related to one another. However, Applicant respectfully submits that all of the elements "substrate," "field emitter," "source" and "ballast resistor" of Claim 67 are interconnected to one another as clearly recited in the claim.

Discussion of Claim 69

The Examiner asserts that Claim 69 is indefinite as it is not clear if the claimed invention includes different materials with opposite conductivity in the field emitter (or proximate to it) or

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not. As discussed in detail in connection with Claim 51, the term "located in or proximate to the field emitter" is clear and definite. Thus, Applicant respectfully submits that Claim 69 is clear and definite.

Discussion of Claim 78

The Examiner asserts that Claim 78 is indefinite as it is not clear how the different elements of the claimed invention are related to one another. In reply, Applicant has amended the language from "at least two controlled electron source" to "at least two controlled electron source arranged on the substrate." Thus, the two elements are interconnected with each other via the substrate. Thus, Applicant respectfully submits that amended Claim 78 is clear and definite.

Discussion of the Term "Whisker"

The Examiner asserts that the term "whisker" in Claims 51, 82-84 and 86-88 represent "cone" while the accepted meaning of the term is "a thin hair-like crystal structure." Applicant respectfully submits that the term "whisker" in all of the related claims represents "a thin hair-like crystal structure" instead of the term "cone." Applicant believes that the term "whisker" is clearly defined as discussed above in the field of semiconductor technology.

Discussion of Rejection of Claims Under 35 U.S.C. § 102(b)

The Examiner has rejected Claims 51-53, 55, 56, 58, 61-66 and 82-88 under 35 U.S.C. §102(b) as being anticipated by Borel, et al. (U.S. Patent No. 4,940,916). However, all of the above claims are patentably distinguished from the prior art as discussed below.

Rationale of 35 U.S.C. 102

"For a prior art reference to anticipate a claim in terms of 35 U.S.C. 102, every element of the claimed invention must be identically shown in a single reference." *Diversitech Corp. v. Century Steps, Inc.*, 850 F.2d 675, 677, 7 USPQ 2d 1315, 1317 (Fed. Cir. 1988). Applicant respectfully submits that the Borel reference does not anticipate Claims 51-53, 55, 56, 58, 61-66 and 82-88 as discussed below because the prior art reference lacks at least one of the above limitations recited in the rejected claims.

Discussion of Claim 51

Claim 51 recites, among other things, a field emitter, a body of the field emitter being a whisker epitaxially grown on the substrate. The semiconductor terminology "epitaxially grown on the substrate" means grown with the same crystal structure as the substrate. The Borel reference does not disclose anything regarding "epitaxially grown on the substrate." Referring to Figure 4, the Borel patent only discloses that the micropoint (field emitter: 12) is deposited on the second resistive layer (24) of the conductive layer (5). That is, Borel does not disclose that the micropoint (12) is epitaxially grown on the substrate recited in Claim 51.

In view of the above, Claim 51 is not anticipated by the Borel reference, and thus the claim is patentable.

Discussion of Claim 82

Claim 82 recites, among other things, forming within the field emitter at least one junction between materials having opposite electrical conductivities.

Referring to Figure 4 and column 6, lines 24-29, the Borel reference only discloses that the second resistive layer (24) is deposited between the micropoint (field emitter: 12) and the conductor layer (22). That is, the Borel reference does not disclose anything regarding "forming within the field emitter at least one junction between materials having opposite conductivities."

In view of the above, Claim 82 is not anticipated by the Borel reference, and thus the claim is patentable.

Summary

As discussed above, Claims 51 and 82 are not anticipated by the Borel reference. The remaining claims depend from one of corresponding base Claims 51 and 82 and further define additional technical features. In view of patentability of their base claims and further additional features, the dependent claims are also patentable. Thus, withdrawal of the rejections is respectfully requested.

Discussion of Rejection of Claims Under 35 U.S.C. § 103(a)

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The Examiner has rejected Claims 54, 59, 60, 67 and 78-81 under 35 U.S.C. §103(a) as being unpatentable over Borel, et al. (U.S. Patent No. 4,940,916). However, all of the above claims are patentably distinguished from the Borel reference as discussed below.

Discussion of Claims 54, 59 and 60

Claims 54, 59 and 60 depend from independent Claim 51 and further define additional technical features. As discussed above, Claim 51 is patentable over the Borel reference. In view of patentability of their base claim and further additional features, Claims 54, 59 and 60 are also patentable. Thus, withdrawal of the rejections is respectfully requested.

Discussion of Claim 67

Claim 67 recites, among other things, at least one ballast resistor configured as a junction between semiconductor materials with opposite conductivities located in or proximate to the field emitter. However, the Borel reference does not disclose or teach the above features recited in Claim 67.

Referring to Figure 4 and column 6, lines 24-29, the Borel reference only discloses that the second resistive layer (24) is deposited between the micropoint (field emitter: 12) and the conductor layer (22). That is, the Borel reference does not disclose, teach or suggest anything regarding "a junction between semiconductor materials with opposite conductivities."

In view of the above, Claim 67 is patentable over the Borel reference. Thus, withdrawal of the rejections is respectfully requested.

Discussion of Claim 78

Claim 78 recites, among other things, at least two controlled electron sources arranged on the substrate. However, the Borel reference does not disclose or teach the above features recited in Claim 78.

Referring to Figures 2-4, Borel only shows one micropoint structure (12). That is, Borel does not disclose or teach anything regarding "at least two controlled electron sources arranged on the substrate." There is no motivation or suggestion by Borel or elsewhere to have a plurality of these structures.

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In view of the above, Claim 78 is patentable over the Borel reference. Claims 79-81 depend from base Claim 78 and further define additional technical features. In view of patentability of the base claim and further additional features, the dependent claims are also patentable. Thus, withdrawal of the rejections is respectfully requested.

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CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance. If the Examiner has any remaining concerns which might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the indicated telephone number.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 3/31/03

By: _____

John M. Carson
Registration No. 34,303
Attorney of Record
Customer No. 20,995
Telephone: (619) 687-8632

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